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NATIONAL RESEARCH COUNCIL COMMITTEE ON UNDERSEA WARFARE

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THE SIXTH UNDERSEA SYMPOSIUM

9-10 May 1951
Washington, D. C.

Opening Address by Gaylord P. Harnwell, Chairman

Address to the Sixth Undersea Symposium by
The Honorable Francis P. Matthews,
Secretary of the Navy

Closing Remarks by Gaylord P. Harnwell

Papers Presented

List of Attendees

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Opening Address by Gaylord P. Harnwell, Chairman
Committee on Undersea Warfare

It is a great pleasure for me acting on behalf of the Undersea Warfare Committee of the National Research Council to welcome the attendants at this the Sixth Undersea Warfare Symposium. The primary purpose of these symposia has been to keep a selected segment of the scientific world informed of the Navy's problems in undersea warfare and to stimulate research directed toward their solution. The early symposia were attended in the main by those, both in and out of uniform, who had been actively engaged in undersea work during the war. In addition to maintaining the interest of many of these people and keeping them currently informed, we have been successful in interesting many new recruits from the scientific fraternity in the very challenging problems presented by this field. On this occasion, as in the past, our audience and speakers represent three main groups; the officers from the fleet who practice the "art" of undersea warfare; the technical officers and their scientific associates who are responsible for the planning and conduct of much of the research and development in this field; and the scientists in the universities and industry who have helped, or we hope will help, the Navy to wage war under the sea more successfully. In addition to these three main groups, we are fortunate in having in attendance representatives from the other services and government agencies, and guests from the United Kingdom and Canada.

We are holding our meeting this year in an atmosphere which is considerably different from that which prevailed on the previous occasions. In the past, most of our effort was directed toward long range objectives; basic scientific and engineering studies, the exchange of information between officers and scientists regarding each other's problems and progress, and the nurturing of that mutual confidence and respect which is indispensable between colleagues in a common cause. This year we are in a state of emergency, and, as you will see from our program, we have shifted the emphasis to be more in keeping with the urgency of the situation. In doing this we feel we must be careful to appreciate that emergencies come in all durations; we must not only be strong today but lay firm foundations for strength in future years as well. In the following papers you will hear of developments for meeting immediate needs, of research directed toward the solution of presently foreseeable problems, and of exploratory research for the future where both the problems and the nature of their solutions, are much less clear. The striking of an optimum balance among these conflicting requirements for men and equipment is one of the most difficult problems facing all of us here today. It is mandatory that we meet our current needs as quickly as possible. It is likewise extremely important that we be prepared to meet those needs that we know will arise in the near future. Along with this, we must be sure not to neglect the more distant future; we must not deplete our basic fund of knowledge in the rush to satisfy current demands--and all this must be done with limited manpower, facilities, and money.

Within this new context, then, and with these formidable requirements in mind we will attempt to present material in the following sessions that will assist us in outlining the undersea warfare problems the Navy must face in May 1951, and will probably face us in the next five to ten years. In the light of a formulation of these problems and the efforts currently being made toward their solution it may be possible to determine what needs most pressingly to be done right now in both planning and execution. It is this question which will engage most of our attention during the next two days. Of the many possible choices among our present needs we must somehow select the most important tasks to be accomplished and devote ourselves to them with the recognition that we are relagating to a subordinate position many valuable projects we would pursue were our resources unlimited.

We scientists like to measure things and have produced some extremely ingenious devices for measuring tangible physical quantities, but we have no specialized techniques for assessing the wisdom with which our efforts are directed. This is a matter of perspicacity and common sense in the assessment of a situation and arriving at honest answers to the following types of questions:

WHAT ARE THE RELATIVE URGENCIES OF THE PROBLEMS?

WHAT ARE THE LIKELIHOODS OF OBTAINING ACCEPTABLE SOLUTIONS?

WHAT ARE THE RESOURCES AVAILABLE FOR THE WORK?

Many things go into the answers to the first question, but one general point worth stressing is the need for thinking in terms of complete systems. For example, if one has an antisubmarine system made up of a vehicle, detection device, fire control system, and weapon, further improvement in some one of these components may not materially increase the effectiveness of the system as a whole, for the limitation in performance may not be imposed by that component but by one or more of the others. It is for this reason that future plans must be based on the need for broad overall operative systems; the crucial components must be carefully singled out and perfected. Along with these efforts to catch up the "laggard" items in the systems, we must also devote some of our efforts to the more imaginative business of probing the unknown, sometimes without apparent direction, for those new concepts that may well result in greatly superior systems for the future.

Our second question, which is that of assessing the likelihood of obtaining a solution to a given problem, is a particularly difficult one to answer, but it MUST be answered if we are to obtain maximum benefit from our efforts. The problem here is the everpresent one facing a research director in a large industry. He has to devote a major portion of his effort to "the sure thing" but he also must

devote some of his effort to the long shots---and he cannot afford to have them all turn out negative, he must be sure that some proportion of them will pay off and assure the company of a successful future. People have tried to write books on how to do this but it is not too far wrong to say that the best way is to put your faith in the judgement of your best men and back them with both moral and tangible support.

The third part of our so-called measuring stick is really in two parts: what resources do we have on hand, and what resources can be made available? Probably the most serious of our limitations with respect to our resources is that of manpower---scientists to do the research, workers to produce the items, and not the least of these, men and officers to maintain and operate them. With respect to facilities and materials, there are always limitations as to the number and amount that can profitably be used. Although one seldom realizes it, money is probably the easiest of all these to obtain. The problems concerning money are not usually ones of amount per se, but rather of consistency---an even level of support over a fairly long period of time. Another problem in connection with research funds is that of flexibility---although support needs to be of a constant level, it is not only desirable but often necessary for the emphasis to be rapidly shifted to those problems that our measuring stick indicates are the ones that are most crucial.

It is within this frame of reference that we present the following four sessions of our program. In this first session, we will attempt to outline the problems facing us and the broad policies within which all of us will try to solve them. We will deal with both specific items in undersea warfare and with items relating to science in general. This latter theme will also be the central one for our dinner at the National Press Club this evening. The second session, to be held in this auditorium this afternoon, will contain presentations on the problems, efforts, and results in locating submarines---still the biggest obstacle facing us in the field of antisubmarine warfare. Although much hard work is yet to be done in this area, you will see that the picture is no longer as black as the one that was painted in these symposia two or three years ago. There is a particularly urgent and formidable problem facing us in undersea warfare at this time, which is that of dealing with mines--particularly the pressure combination ground mine. Tomorrow morning's session in the Department of Interior will, in the main, be devoted to mines, mine countermeasures, and harbor defense. Our final session in the Department of Interior will essentially be devoted to the work and results on vehicles in undersea warfare--surface, air, and submarine.

A symposium is a meeting in which all the participants gather together to exchange ideas, and we hope that as many as possible of you will avail yourselves of the opportunity for discussion at the end of each paper. In line with this exchange of ideas, I think it appropriate at the start of this meeting to give you a few of our ideas--"ours" meaning the Committee on Undersea Warfare of the National Research Council.

Inasmuch as a stated purpose of the National Research Council is to assist and cooperate with government research agencies, the Committee has been faced with the problem of how existing military laboratories might be made more effective. For while in special areas of research it may be necessary to establish additional facilities, this solution is difficult to justify in areas of research for which large facilities already exist unless it can be shown that the possibilities of using these facilities are exhausted. We believe we can help these laboratories to be more effective by assisting them with qualified personnel to stimulate and supplement the efforts of those now employed on the various projects and programs being carried on within them. It is difficult for the Navy to obtain, in peacetime, the services of certain people whom they would most desire. Here the Committee may be able to help and to secure to the Navy the benefit of such people in the planning and initiation of projects and in subsequent general supervision and consultation.

For this reason the Committee is proposing to answer a specific request from the Chief of Naval Research to assist in the acoustic mine location problem by organizing a research group to work intimately with one of the existing Naval laboratories during the coming summer. This will not be a competing team but new key players for the line and back field, and some help in the coaching staff of the laboratory; to help the laboratory people play their best game using their own signals, on their own field, and under their own captain, against our common opponent. We hope we can help in the analysis of physical and system factors and in the preparation, initiation, and prosecution of the key experiments and developments upon which a successful system will depend. We also hope it will demonstrate a successful pattern of approach that can be more widely extended.

The problem selected for this team has been already referred to--that of determining the design parameters of a mine countermeasures system with particular emphasis on the location and disposition of ground mines in shallow water. A number of the Committee members and other volunteers have agreed to work essentially full time for the entire summer in a concentrated effort to launch a program which will then continue with decreasing assistance from us. We would welcome hearing from others who would like to join us. The Navy Electronics Laboratory at San Diego was selected by all concerned as being most suitable for this first National Research Council effort toward assisting on short range, urgent programs and in going there we are responding to a cordial invitation from the Director. You will hear more of the details of this program tomorrow morning from some of those directly participating, and from others in universities and Naval billets supporting this cooperative effort.

I would not like to conclude these opening remarks without a brief tribute to Dr. J. T. Tate under whose inspiring leadership the Committee has operated during the past five years. He had as you know previously been chairman of the Undersea Warfare Division of the National Defense Research Committee and a very considerable percentage of the civilian scientists now engaged in Undersea Warfare problems for the Navy

were drawn into this work either directly or indirectly as a result of his efforts. My participation for instance began with a long distance call from him one evening immediately after his return from England in the early autumn of 1941. He could only tell me that the German submarine threat was a serious menace to our country, that scientists were needed to improve our ability to counter it, and that he himself was going to devote himself to the work. Would I join him? My respect for his judgement and admiration for his qualities of integrity and leadership led me to say yes immediately. The brightest thread in the grim fabric of war research and development during the next five years was my personal experience of the strength and the wisdom and the kindliness which characterized his leadership. His death this winter has been a serious professional and personal loss to us all.

Address to the Sixth Undersea Symposium by
The Honorable Francis P. Matthews,
Secretary of the Navy

Dr. Harnwell, Admiral Akers, Members of the Advisory Committee on Undersea Warfare, distinguished Ladies and Gentlemen: I would lack entirely a sense of the proper propriety if I fail to express to you my deep appreciation of the compliment implied in affording me the opportunity of saying a few brief words to you this morning. I am conscious of the sacrifice many of you have made to be here making possible this splendid attendance at this setting. It reflects the sincerity of the contribution to the objectives to which this organization entertains.

We in the Navy are deeply grateful for the part that you play in promoting the program to develop our ability to meet the challenge of undersea warfare as conducted by our enemies and our possible enemies. Even as a civilian--you might say a mid-Western country lawyer--I realize that this country and its allies almost lost two wars by reason of the submarine menace and I can, therefore, readily understand the high importance of your deliberations to the welfare of this country and for the good of the world. As a lawyer, also, I am conscious of the contribution that is made to the American way of life by the scientific men of our nation. We in practice of law, especially those of us who devote ourselves toward corporation practice, are quite closely in touch with the interest of our clients, those clients who are engaged in the industrial field. We know of the contributions, the vast contributions, that have been made by scientific men by the progress that has resulted in industry and in the production which has been accomplished for the good of our people, our businesses, and for the comfort of our citizens through the foresightedness, through the intelligence, the devotion and through the practical accomplishment of scientific men. So, I, individually, can well appreciate the value of your services in the capacity which brings you here this morning.

The Navy, as I said, is grateful to you. It hopes that in some way it can make some contribution to your deliberations and to your work. I can assure you that all of us in our civilian professional capacities are ready to extend to you, first of all, a feeling of deep appreciation and deep gratitude for your willing attitude of helpfulness, and may I say in concluding that we have nothing but great admiration for what this particular body is doing in this special field to which you devote yourselves in your deliberations for the next few days, and also in the things that you are doing for the Navy, for America and for the world. There never was a time in our history, there was never a time in <u>all</u> history when the consecrated self-sacrificing devotion of men like those of you whom I see in this audience before me was so completely American, and it gives a great feeling of confidence and assurance that you will come here, take the time and dedicate yourselves to the purposes and the accomplishments which are, I know, to transpire and benefit what is to come from your deliberations during the next few days.

Thank you and good luck to you.

Closing Remarks by the Symposium Chairman,
Dr. Gaylord P. Harnwell

Gentlemen: I will not endeavor to summarize these two sessions, because they have covered such a varied field of topics that this would be quite impossible. I think that many of us take away particularly information about those fields that are closest to our own interests, and only a considerably lesser percentage of the material to be gained on those fields that are more remote. And this is, I believe, quite appropriate.

I hope you have all learned something about the different aspects of undersea warfare, but that you were particularly helped in those fields in which you yourselves must work.

I was very glad, indeed, to hear Admiral Akers outline the three fields which he considers most important, and to realize that at least in two of those very promising work is in hand, or well started. I refer primarily to the low-frequency listening work, and to the mine detection problem. And I trust that the identification problem will emerge as a by-product, possibly from one or both of these other sonar investigations--because it seems to me that there is this likelihood.

I would also like to make one or two other very brief remarks. One of these relates to the fact that our friends in the air seem to be getting closer and closer to the surface, with the helicopter; and our friends on the surface seem to be endeavoring to take off with the hydrofoil.

This, to my mind, is a very promising type of approach, because, I might parenthetically remark, through a wise dispensation of providence, it is the Navy that has been entrusted with the safety of the country, rather than the scientists--and the Navy thinks in a very orderly fashion, approaching things by objectives and by operational requirements, and by rather long words and many pieces of paper, which, however, get there in a very thorough and very assured way. And the scientist--at least if I'm at all representative of him--does things in a completely different spirit. I like to see the helicopter and the hydrofoil getting closer together, because it seems to me that by so doing, we really are exploring all of the possibilities which we must depend upon in order to be successful in a field such as warfare.

In particular, the field of undersea warfare has for some time seemed to me to be one that has lacked some of this scientific approach--because it has been looked upon as a field in which one could write operational requirements for the distant future rather more simply than for the immediate future. I can understand the writing of these requirements when one knows what one wants, and this is a situation which promotes development within the next year or the next two years. It is much more difficult to write these requirements when we know that we will have to be strong

five or ten years hence. It is true that we must look at this problem in a more general way, but that without scientific guidance, this generality is actually emerging from naval planning.

The short-range problems that we have heard brought out, and their solutions discussed, have, almost all of them, within them the germs of the selection of longer-range problems. I wouldn't want to enter the controversy between Dr. Hill and maybe Dr. Hunt on the one side, who feel that the days of the submarine are numbered, and Captain Sieglaff, who very ably supports the other side in which its days are not only not numbered, but the days of every other type of ship are numbered. But I am glad that Captain Sieglaff brought this out, because while I would not like to take sides, I would be very much disappointed if one did not develop the type of sonar which would be most effective were the submarine to remain with us--and I rather believe it will.

The sonars which we saw in the picture, on the SSK, are of many different varieties; but when you look at those, you find that they are by no means the ultimate in sonars, but they represent a degree of indefiniteness in the information which comes out, with which the surface sailor would be completely unhappy, and would make violent demands for great improvement if this were the type of definition he got on his radar. The people who have worked under the sea have been satisfied with a five-line television screen rather than a hundred-line television screen. There is no reason, I believe, why they should be satisfied with this--but, not knowing any better, there has been no demand for it.

However, as experience increases by our submariners and by the people who are working in undersea warfare, I'm sure the possibilities will eventually be appreciated, the demands for equipment will come, and a very different picture of the possibilities of the submarine operating in the sea will probably be presented to you five years hence.

In conclusion, I would like to express the appreciation of the Committee for the presence of many of you here who have come from somewhat outside the ordinary call of your duties--and we are very glad, indeed, that you came. We hope that you have profited by this, and we hope we will hear from you in regard to suggestions which occur to you along the lines of the discussion.

We also want to thank the Office of Naval Research for their support, and particularly the retiring Chief of Naval Research, Admiral Solberg, who has been such a staunch reed upon which we have leaned during the past years of his incumbency. He has told us of the pleasure we have given him on some occasions, and the headaches we've given him on others. All we can say is that we cannot sincerely be of service to him and guarantee it will be fair weather

all the time, because we will have to be quite honest and sincere in our views. Otherwise, we had best be left ashore and not taken along.

I would also like to thank the local Committee for all of the arrangements they have made for us, and the very successful symposium which has resulted.

Thank you very much, gentlemen. The symposium is adjourned.

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Rear Admiral Frank Akers, USN
Office of the Chief of Naval Operations

NRC:CUW:0116 DETECTION OF SUBMARINES FROM THE SURFACE AND BELOW
Captain W.L. Pryor, Jr., USN
Bureau of Ships

NRC:CUW:0117 AERIAL DETECTION OF SUBMARINES
Dr. K.C. Black
Naval Air Development Center

NRC:CUW:0118 AIRBORNE MEASUREMENTS OF THERMAL RADIATIONS FROM SUBMARINE WAKES
Mr. Harry Clark
Naval Research Laboratory

NRC:CUW:0119 SUBMARINES IN ANTISUBMARINE WARFARE
Captain W.B. Sieglaff, USN
Submarine Development Group TWO

NRC:CUW:0120 UNDERSEA WARFARE SHIPS
Rear Admiral W.D. Leggett, USN
Bureau of Ships
presented by-
Captain E.A. Wright, USN
Bureau of Ships

NRC:CUW:0121 THE PRIMARY BATTERY
Captain J.S. McCain, Jr., USN
Office of the Chief of Naval Operations

NRC:CUW:0122 NAVAL APPLICATIONS OF HYDROFOILS
Dr. E. Bromberg
Office of Naval Research

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Rear Admiral R.L. Hicks, USN (Ret)
U.S. Maritime Administration

NRC:CUW:0124 BUREAU OF ORDNANCE RESEARCH AND DEVELOPMENT
Rear Admiral J.A. Snackenberg, USN
Bureau of Ordnance
THE REPORT OF THE BUREAU OF ORDNANCE COMMITTEE ON TORPEDO RESEARCH AND DEVELOPMENT
Mr. Earl Finkle
Bureau of Ordnance

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Dr. L.W. McKeehan
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Mr. John S. Coleman
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U.S. Navy Electronics Laboratory

NRC:CUW:0126 HELICOPTERS IN ANTISUBMARINE WARFARE
Lieutenant Commander W.G. Knapp, USN
Bureau of Aeronautics

NRC:CUW:0127 UNDERSEA WARFARE RESEARCH AND DEVELOPMENT
Rear Admiral T. A. Solberg, USN
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NRC:CUW:0128 MINE WARFARE IN KOREA
Commander N.B. Atkins, USN
Office of the Chief of Naval Operations
presented by-
Captain F.S. Steinke, USN
Office of the Chief of Naval Operations

NRC:CUW:0129 THE NATIONAL SCIENCE FOUNDATION
Dr. Alan T. Waterman
National Science Foundation

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Mr. Larned A. Meacham
Bell Telephone Laboratories

NRC:CUW:0132 MINES, MINE COUNTERMEASURES, AND HARBOR DEFENSE
Captain A. C. Burrows, USN
Office of the Chief of Naval Operations

NRC:CUW:0133 MILITARY RESEARCH POLICY
Mr. William Webster
Research and Development Board

NRC:CUW:0134 THE HARTWELL PROJECT
Dr. Jerrold Zacharias
Massachusetts Institute of Technology
presented by-
Dr. A.G. Hill
Massachusetts Institute of Technology

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LIST OF REGISTERED ATTENDANCE AT

SIXTH UNDERSEA SYMPOSIUM

May 9-10, 1951

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